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DESCRIPTION OF A NEW COCKLE
(MOLLUSCA: BIVALVIA)
FROM THE PLIOCENE OF NORTHERN CALIFORNIA

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ABSTRACT: *Clinocardium lispum* Roth and Talmadge, new species, is described from the Rio Dell formation, Pliocene of Humboldt County, California. It differs from other western American species of *Clinocardium* in having very numerous, fine, flat-topped ribs separated by linear interspaces.

The western American Cenozoic species of the cardiid bivalve genus *Clinocardium* Keen, 1936, were reviewed by Keen (1954) who recognized eleven valid taxa in western North America. More recent studies have added the following taxa to the list: *Clinocardium meekianum myrae* Adegoke, 1969, from the Etchegoin formation (Pliocene) on the west side of the San Joaquin Valley, California; and *Clinocardium hopkinsi* Kanno, 1971, from the Poul Creek formation (probably lower Miocene) near the head of the Gulf of Alaska. *Cardium (Papyridea) brooksi* Clark, 1932, although assigned by Keen (1954) to *Fulvia* Gray, 1853, has been assigned to *Clinocardium* by Addicott, et al. (1971) and by Kanno (1971). If this middle Miocene species is a *Clinocardium*, it is unusual in having nearly orthogyrate beaks.

An additional, unnamed, species of *Clinocardium* has come to light in the course of our faunal studies of some of the Tertiary deposits of northwestern California and southern Oregon. Between 1967 and 1973 both of us collected specimens of the new species from the Rio Dell formation of the Wildcat group (Pliocene) near Scotia, California. Subsequently, more and better preserved material was found in the collections of the Museum of Paleontology, University of California, Berkeley.

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Family CARDIIDAE Lamarck, 1809

Subfamily LAEVICARDIINAE Keen, 1936

Genus *CLINOCARDIUM* Keen, 1936

Type-species, by original designation, *Cardium nuttallii* Conrad, 1837; Pliocene to Recent, northwest America to Japan (Kilmer, 1973).

Shell oblique-elliptical to subquadrate; radial ribs prominent except on posterior slope, ornamented with cross-threads; hinge long and arched, ligament long, low, narrow; beaks markedly prosogyrate; cardinal *4b* weak, left posterior lateral double (diagnosis modified after Keen, 1954, 1969).

The genus is confined, in both Recent and fossil occurrence, to the margins of the north Pacific Ocean basin, except for one species, *Clinocardium ciliatum* (Fabricius, 1780), which ranges from Washington and Japan into the Arctic and north Atlantic Oceans. A recently published synopsis of Cardiidae with type localities in Japan,

Sakhalin, and Kamchatka (Keen, 1973) lists 24 nominal species in *Clinocardium*, ranging stratigraphically from upper Oligocene to Recent.

Clinocardium lispum Roth and Talmadge, new species.
(Figure 1.)

Clinocardium aff. *C. pristinum* Keen, Faustman, 1964, p. 120,
pl. 1, fig. 7, text fig. 7.

DIAGNOSIS. A large, compressed, inequilateral *Clinocardium* with very numerous, fine, flat-topped ribs separated by linear interspaces.

DESCRIPTION. Shell moderately thick, ovate-trigonal, inequilateral, compressed, longer anteroposteriorly than high; beaks moderately inflated, strongly prosogyrous, situated about one-quarter of the distance from anterior extremity; surface sculptured with (on holotype) 59 smooth, rounded to flat-topped radial ribs, with the narrow interspaces linear over most of the disk but at posterior angulation and on extreme anterior portion of shell approaching the width of the ribs; ribs crossed by weak concentric threads near ventral margin. Posterior angulation marked by two or three more prominent ribs. Ribs on posterior slope not markedly weaker than remainder but more angular in section, the posterior facet of each rib sloping more gently than the anterior. Interior of valve reflecting surface sculpture. Hinge line long, hinge teeth not exposed in any specimens seen. Length of holotype 59.0 mm., height 51.6 mm., convexity (one valve) 15.7 mm.

TYPE LOCALITY. University of California Museum of Paleontology invertebrate locality B-7643, NW 1/4, SE 1/4 sect. 5, T. 1 N, R. 1 E, United States Geological Survey Scotia, California, quadrangle (15 minute series, topographic; 1950 edition); Rio Dell formation. Along railroad tracks from 2829 to 2945 feet northeast of the U.S. Highway 101 bridge over Eel River; stratigraphically, from 2010 to 2090 feet above base of Rio Dell formation; fine- to medium-grained light gray silty sandstone, well indurated.

TYPE MATERIAL. Holotype, a left valve, University of California Museum of Paleontology No. 14152. Paratype, a right valve, UCMP No. 37774. Replicas of the holotype have been deposited in the California Academy of Sciences, the United States National Museum, and the Los Angeles County Museum of Natural History.

REFERRED MATERIAL. UCMP B-7643, nine additional specimens from the type locality which are not designated paratypes because of their poor preservation. UCMP 1875, equivalent (*vide* Faustman, 1964) to UCMP B-7642, NW 1/4, SE 1/4

sect. 5, T. 1 N, R. 1 E, Scotia quadrangle, along south bank of Eel River, stratigraphically 2165 to 2310 feet above base of Rio Dell formation; one specimen, collected by Bruce Martin, 1911. California Academy of Sciences, Department of Geology locality 54620, SE 1/4, SW 1/4 sect. 5, T. 1 N, R. 1 E, Scotia quadrangle, poorly sorted, dark gray fine silty sandstone exposed in cut bank along railroad tracks on southeast side of Eel River, stratigraphically approximately 1250 feet above base of Rio Dell formation (and thus equivalent to UCMP B-7640, as described by Faustman, 1964); six specimens. Talmadge collection, Eureka, California: Locality T-1-67, south bank of Eel River, below railroad tracks at the "rocky knob;" two specimens. Locality T-8-67, north bank of Eel River, approximately 900 feet downstream from U.S. Highway 101 bridge; one specimen. Locality T-1-67 is slightly lower in the section than UCMP B-7643; locality T-8-67 may represent a continuation of one of these strata across the Eel River.

COMPARISONS. This species was cited and figured by Faustman (1964) as *Clinocardium* aff. *C. pristinum* Keen, 1954, and was not further described because of the poor preservation of the material. A well-preserved left valve--the present holotype--was found, however, in a lot of *Clinocardium meekianum* (Gabb, 1866) from locality B-7643; it is clearly separable from *Clinocardium pristinum*. That species, from the upper Miocene San Pablo group of Contra Costa County, California, has from 42 to 48 radial ribs and is more tumid and more nearly trigonal than *C. lispum*. "*?Cardium (Cerastoderma) cf. corbis* (Martyn)" of Etherington (1931, page 77, plate 5, figure 11) from the Miocene Astoria formation of Washington, which Keen (1954) doubtfully referred to *Clinocardium pristinum*, differs from *C. lispum* in being more orbicular, higher than long, and in having fewer ribs.

Clinocardium hopkinsi Kanno, 1971, from the Poul Creek formation, upper Oligocene to lower Miocene of Alaska, may be the species most similar to *Clinocardium lispum*. It has fine, rather flat-topped radial ribs and concentric threading which is most strongly expressed near the margin. The beaks of *C. hopkinsi*, however, are less strongly prosogyrous than those of *C. lispum*, its ribs number about 40, and it is more nearly equilateral. Other western American species of the genus, as enumerated by Keen (1954), seem not to require detailed comparison, as none has the very fine, numerous, flat-topped ribs and linear interspaces of the present species.

The most similar Asian species appears to be *Clinocardium subdecussatum* Shuto, 1960, from the upper Miocene of Miyazaki Prefecture, Kyushu, Japan, which is a much smaller form with decussate sculpture.

Dall (1902) reported *Serripes groenlandicus* "Beck" (= *S. groenlandicus* [Bruquiere, 1789]) from "bluffs opposite Rio Dell." This record has not been verified by later workers and may have been based on specimens of the new species.

Likewise, Martin's (1916, page 251) record of "*Cardium coosensis* Dall" from the Middle Wildcat group may have been based on *Clinocardium lispum*.

AGE AND PALEOECOLOGY. Available material indicates that this species is limited to the middle portion of the Rio Dell formation in its type section along the Eel River northeast of Scotia. We have not found it in collections from elsewhere in the Rio Dell formation or from sediments of the undifferentiated Wildcat group northeast of Fortuna.

Most authors since Gabb (1866) have assigned fossils from the Wildcat group a Pliocene age. Literature on the subject is summarized by Stewart and Stewart (1949) and by Faustman (1964). An analysis of megafossils led Faustman to suggest at least partial correlation of the Rio Dell formation with the lower Merced formation of the San Francisco Bay area, the Etchegoin formation of the San Joaquin Valley, and the Empire formation at Coos Bay, Oregon; these units are Pliocene in the traditional terminology of west coast paleontologists. The Eel River formation, which underlies the Rio Dell formation, contains at least one volcanic ash bed (Ogle, 1953), which should permit radiometric dating.

MacGinitie (1942 [1943]) remarked on the close correspondence between microfossils in the Pliocene formations of Humboldt County and Ventura County. Ogle (1953), under the heading of "Correlation," stated that the Rio Dell formation is equivalent to the Pico formation of the Los Angeles and Ventura basins. Ogle's list of benthic foraminifera from the Wildcat group is more clearly indicative of shallowing bathymetry than of time-stratigraphic relationship (W. F. Barbat, personal communication). Both the lithology and the megafaunal sequence of the Wildcat group have likewise been interpreted to indicate progressive shallowing. Martin (1916) noted a faunal division between the upper and lower Wildcat (at about the middle of the later-defined Rio Dell formation) and suggested that the Miocene-Pliocene boundary might fall there. Later workers (e.g., Faustman, 1964; Talmadge, 1974) have emphasized the shallower-water character of the upper Wildcat fauna.

Faustman (1964) considered the molluscan assemblage in the upper middle part of the Rio Dell formation (which includes the type locality of *Clinocardium lispum*) to indicate deposition in depths of 100 feet or less. The same author's calculation of median midpoint-of-range for an assemblage collected in part at locality B-7643 suggests cooler marine temperatures than those at the same latitude today.

Most of our specimens are abraded, as in figure 1b; some have traces of spirorbid worm tubes inside the valves. The dead shells apparently drifted around the bottom for some time before being covered by sediment.

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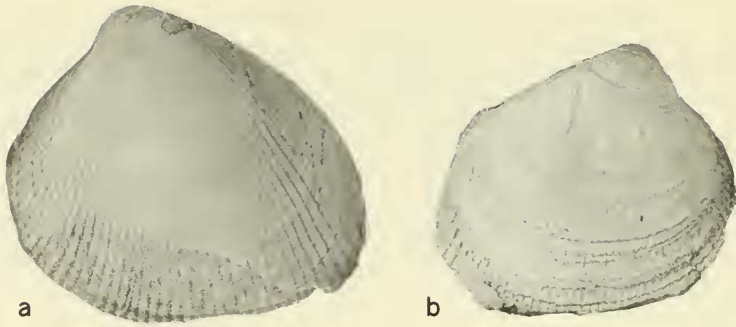


FIGURE 1. *Clinocardium lispum* Roth and Talmadge, new species. a. Holotype, University of California Museum of Paleontology No. 14152. Rio Dell formation (Pliocene), near Scotia, California. Length 59.0 mm. b. Paratype, University of California Museum of Paleontology No. 37774. Rio Dell formation (Pliocene), near Scotia, California. Length 42.3 mm.